Abstracts of Technical Reports

ACAE WORKSHOP

10th Anniversary

Fredericton Motor Inn

Fredericton, N.B.

February 21 - 23, 1990

1990

Prepared by the Atlantic Committee on Agricultural Engineering. (ACAE)

Published by the Authority of the Atlantic Provinces Agricultural Services Co-ordinating Committee

ACAE PUB. NO. 24 AGDEX - 704

ABSTRACTS OF TECHNICAL REPORTS

ACAE WORKSHOP

G.C. Misener, C.D. McLeod, and P. Milburn

91-01043/

CONTENTS

INTRODUCTION

K.C. Watts, Chairman, ASAE 1

GENERAL SESSION

Repairs to the Tantramar River Dam 2
The Need for a Standardized Approach in Sprayer Calibration 2
Use of Polyethylene Pipe in Construction of an Aboiteau 3
The Development, Design, Construction, and Calibration of a Direct Injection Plot Sprayer 3
Forced-Air Precooling of Spinach 4
Swine Housing Systems in the Netherlands 5
Potato Harvester Bed Speed Ratio Determination for PEI Conditions 6
Effects of Intensive Agriculture on Nitrate-N Concentration in Groundwater 6
Graphical Analysis of Ventilation System Performance 8
Irrigation Scheduling-Investigative Travel 8

PLENARY SESSION

Challenges - 90's 10
Atlantic Committee on Animal Production 11
Atlantic Committee on Crops 12
Atlantic Committee on Food 14
Atlantic Committee on Socio-Economic Services 15
Atlantic Committee on Soil and Climate 16
Atlantic Committee on Agricultural Engineering 18

POSTER SESSION

The Use of Computerized Surveying Equipment in the Design and Setting Out of Erosion Control Structures 19
Evaluation of an Automatic Depth Controller 20
Nova Scotia Erosion Risk Potential 20

Identification of Mechanical Injury of Potatoes on Packing Lines 21
Computer Assisted Layer Management 21
A Management System for the Monitoring of Impact Damage to Fruits and Vegetables 22
Subsurface Drainage Performance on a Queens Soil 22
An Image Acquisition and Processing System for a Robotic Strawberry Harvester 23
Bruising Location on PEI Harvesters 23

CONCURRENT WORKSHOPS

Power and Machinery
Lubricants and Their Uses 24
Pesticide Application Technology 25
Aerial Sprayer Technology 25

Soil and Water
Soil and Water Projects in Western Canada 26
The Federal Environmental Assessment and Review Process 27
The Environmental Assessment Process Within the Agriculture Development Branch 28

Structures and Environment
Dairy Housing Systems as We Approach the 21st Century 29

PHOTOS FROM THE 1990 WORKSHOP 31

INTRODUCTION

K.C. Watts

Chairman, ACAE

A milestone was reached in the conducting of the Annual Workshops of the Atlantic Committee on Agricultural Engineering. The Tenth Workshop was held at the Fredericton Inn in Fredericton, New Brunswick, February 21 - 23, 1990 with the theme of "Challenges for the 90's".

This milestone was particularly innovative in that the chairmen of the sister Atlantic Committees were invited to discuss their views on where Agricultural Engineering should be heading in the decade to come; or in other words, to define for us the challenges for the future. It was very helpful to hear from our counterparts their views on the direction in which we should be heading and it was also good to have the Deputy Minister of Agriculture from New Brunswick chair this session so as to gain from his experience.

The word "challenge" was noted in the opening session of the Workshop as being defined as: "an invitation or dare to participate in a game, contest, or fight"; or "a calling in doubt, a doubt, or dispute." Thus it was suggested that the aims of this Workshop could be listed as:

1. to question where we are going
2. to understand where we are going
3. to become better equipped to meet these challenges
4. to be motivated to meet these challenges,

and I am sure that the Workshop will be remembered as one in which these aims were accomplished.

I would like to thank the Organizing Committee for their leadership, innovative thinking, and hard work that was evident in putting together this successful Workshop. I would also like to record my appreciation to the Workshop leaders and speakers for their input to this Workshop for they are the people that gave the solid base for equipping us all to meet the challenges for the future. Finally, I would like to thank the staff at Agriculture Canada Research Station for putting together another quality compendium of the Abstracts.

Repairs to the Tantramar River Dam

Laurie Collette
NB Department of Agriculture, Moncton

The Tantramar River Dam was built in 1960. This structure protects 18 000 acres of land in the Sackville area. Two steel gates in the structure control the water level in the river system above the Dam. The gates are held in place by steel guides. The lifting and lowering of the gates over the past 26 years has resulted in severe wear on these guides.

In 1986, a request to repair the gates was submitted. Proposal for design of unwatering gates and procedures for repairs were received the same year. In 1987 the services of the engineering firm Crandall & Associates Ltd. were retained. Specification and tenders were prepared. Repair to the Dam was carried out in summer of 1988 and 1989. The total cost of the project was approximately $1 000 000.

The Need for a Standardized Approach in Sprayer Calibration

Ken Lingley
PEI Department of Agriculture, Charlottetown

At present, there are numerous field sprayer calibration methods being used and promoted by government extension services and chemical industry representatives. This unorganized approach to a very important aspect of chemical usage has increased the confusion and decreased the willingness of the farmers to perform the necessary calibration. The establishment of provincial certification systems for commercial chemical applicators will occur in the next few years. It is an opportune time for the agricultural engineers in Atlantic Canada to establish a standardized calibration method and implement this in their provincial training programs. The calibration procedure should be one that is simple, yet leads to an enhanced understanding of the basic principles governing application.

Use of Polyethylene Pipe in Construction of an Aboiteau

Hank Kolstee
NS Department of Agriculture and Marketing, Truro

Nine years ago, the Nova Scotia Department of Agriculture used, for the first time, high density polyethylene pipe for the reconstruction of aboiteaux. Since that time, pipe varying in size from 11" to 56" in diameter has been used. Flow characteristics of these pipes are very good, although thermal expansion and contraction can cause problems under certain conditions. Pipes are somewhat flexible but they can withstand a lot of abuse.

The Development, Design, Construction, and Calibration of a Direct Injection Plot Sprayer

Allan Campbell
Agriculture Canada, Research Station, Charlottetown, PEI

To reduce the amount of wastage caused by having to dump tanks with water and chemicals after spraying plots, a decision was made to add a direct injection spray unit to an existing plot sprayer. An injection system was designed with a peristaltic pump and 6 one-litre chemical bottles. The sprayer piping was modified to bring the injection line, the relief line, and the by-pass line back into the pump suction line. A detailed calibration system was developed using an injection chemical of 1000 ppm chloride solution. Concentrations of chloride were then measured in the boom discharge to determine the injection delays, wash down times, cross contamination, and other sprayer parameters. Extensive testing has concluded that the injection mechanism can be successfully used to spray research plots.

Forced-Air Precooling of Spinach

Ian M^{ac}Kinnon
Agriculture Canada, Research Station, Kentville, NS

A forced-air precooler for fresh market spinach was developed and tested for the 1989 growing season. The precooler consisted of several stand-alone fan and bin units placed in cold storage rooms. The precooler fan and bin units consisted of a bin built from 16 mm plywood and measured 1.2 m x 1.2 m x 1.2 m high with holding capacity of up to 135 kg of field packed spinach. The bottoms of the bins were framed to allow 100 mm openings for fork lifts from two sides. The bin bottoms were perforated to 10% of the total bottom area to allow movement of air. Several bins can be placed in the cold storage up to a maximum of 10 at any one time. A lid for each bin was designed that contained a 45 cm diameter, 0.36 kW fan, housed in the center of the plywood lid. The fans created a negative pressure to pump cold, room air up through the perforated floor and the spinach in the bin and then the air was discharged vertically toward the evaporator coils. Cooling half-times in the range of 1 - 2 hours were recorded with very little leaf wilt occurring. The fans delivered air flows in the order of 0.23-0.71 m^3/s with pressure differentials of 50 - 100 Pa. The mass of the spinach in the field bins was estimated from the known amount of packaged spinach obtained after washing and sorting. A 10% - 15% cullage is estimated for the sorting line. The forced-air precooler allowed the grower to hold field packed bins up to several days, if necessary, thereby allowing more flexibility in marketing. Total production for the 1989 growing season was in the vicinity of 50 000 kg with plans to double production for the next year.

Swine Housing Systems in the Netherlands

Graeme Linkletter
PEI Department of Agriculture, Charlottetown

During April 1989, the author, along with a group of PEI swine farmers arranged and participated in a seven day Swine Housing Systems Tour in the Netherlands and West Germany.

Contacts were made with manufacturers of automatic feeding equipment and other hog equipment manufacturers and these firms conducted the farm tours.

The majority of the farms visited were quite large; 150-600 sow farrow-to-finish operations with computerized liquid feeding systems. Several of the farms utilized waste byproducts from dairy and vegetable processors as a major source of their feed requirements.

The majority of swine buildings visited were of a similar design and type and differed considerably from the typical Canadian swine building.

The typical feeder barn consisted of the following main features:

- 40′- 44′ wide with heated service alley along one wall
- multiple rooms with 8 pens for 80 hogs
- fully slatted floors in pen area
- manure storage under slats
- heated hallways and pen floors
- automatic modulating ventilation control
- cathedral type ceilings - rigid insulation
- double brick walls with insulation
- computerized feeding system

The sow barns were also multiple rooms (8 sows) with ample supplemental heat, automatic ventilation, separate weaner rooms and liquid feeding. Some of the management systems featured group housing of the dry sows with a computerized group feeding system.

The swine housing systems visited gave the tour group the impresion that the swine industry in the Netherlands is a very large industry (15 million hogs marketed/yr.) with modern well equipped buildings and management systems. The buildings were expensive and if they were to be built in Canada, the capital costs would be substantially higher than our present type of construction.

Potato Harvester Bed Speed Ratio Determination for PEI Conditions

Tony Glencross

PEI Department of Agriculture, Charlottetown

The ratio of potato harvester bedspeeds, to one another and to the forward speed of a potato harvester, have been determined to have a major effect on the bruise levels of potatoes passing through the machine. The availability of a potato harvester, in which all beds were hydraulically driven and controlled, allowed testing to occur in the fall of 1989 which established the ratios of the harvester bed speeds that resulted in minimum damage. This presentation will outline the project and the results that were obtained in the conditions encountered in the fall of 1989.

Effects of Intensive Agriculture on Nitrate-N Concentration in Groundwater

P. Milburn[1], J.E. Richards[1], and C. Gartley[2]

[1]Agriculture Canada , Research Station and [2]NB Department of Agriculture, Fredericton

Two studies were conducted to assess the extent of NO_3-N leaching associated with intensive potato production in north western New Brunswick. Both were on-farm, field scale studies. The first study was conducted to determine if NO_3-N concentrations of systematic subsurface drainage waters (and total NO_3-N leached) were higher from soils cropped to potatoes than from soils cropped to cereals or hay. Drainage discharge from five independent sites was monitored for flow rate and total volume, and samples were collected and analyzed during two growing seasons. The objective of the second study

was to determine if intensity of land use, and in particular potato production, affected NO_3-N concentrations of 47 private wells located in three agricultural regions. A secondary objective was to determine if the concentrations of NO_3-N changed over 15 yr in these wells (1973-1988).

In the first study, flow-weighted average nitrate concentrations of the drain outflow (April-December) were greater than 10 mg L^{-1} for established potato rotation sites, both in the year of potatoes and in the subsequent non-potato year when the rotation crop received little or no fertilizer. Corresponding average nitrate concentrations at low input, non-potato rotation sites were approximately 3 mg L^{-1}.

In the second study, mean well water NO_3-N concentrations in the three agricultural areas were associated with the proportion of the land base cropped to potatoes. Mean NO_3-N concentrations in 1988 were 9.5, 5.6, and 5.0 mg L^{-1}, compared to 1.1 mg L^{-1} for a rural non-agricultural area near Fredericton. In one of the agricultural regions, the mean concentration of NO_3-N decreased over fifteen years while there was no significant change in NO_3-N concentrations in the other two agricultural regions.

Taken together, these studies illustrate the potential negative impact of intensive agricultural production on both shallow and deep groundwater quality. Our results are similar to those of other studies reported in the literature, except that mean NO_3-N concentrations of well waters in our study were stabilized or decreasing with time rather than increasing. Decreased potato acreage may be part of the reason, but we speculate that better crop management is also a factor. Further research that examines the total nitrogen balance of cropping systems common to Atlantic Canada is both warranted and recommended.

Graphical Analysis of Ventilation System Performance

James Shand

Life Line Software Ltd., Truro, NS

A graphical approach to the analysis of ventilation system performance in livestock buildings will be outlined in this paper. A computer program has been developed to process sensor readings and display a 'heat map', a graphical representation of spatial temperature variations within a livestock building (eg: egg layers). The picture is color-coded for 13 temperature ranges, including outside temperature. The computer program makes 288 pictures for each 24 hour period. These pictures may be played backward or forward, like a movie, to provide a dynamic, visual display of temperature conditions throughout the production area. This type of analysis can lead to a better understanding of the causes of ventilation problems and thus, to better and more effective solutions.

Irrigation Scheduling-Investigative Travel

Trent Webster

Nova Scotia Department of Agriculture, Truro

Two trips were made to study the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) methods of irrigation scheduling.

In East Lansing, Michigan, on March 14-16, 1989, the "SCS Irrigation Scheduling" micro-computer software training course was attended. The Course was put on in co-operation with Michigan State University (MSU), the SCS, and Walid Shayya, who programed the software.

In Portageville, Missouri, on April 18-20, 1989, the "Radiation Safety, Calibration, Use, Transport & Storage of the Neutron Soil Moisture Gauge" course was attended. This was a three-day "hands-on" workshop with the Campbell Pacific Nuclear (CPN) Corporation 503DR Hydroprobe. It was observed to be a very practical irrigation scheduling soil moisture meter.

A report of the trips was written. A proposal to implement an "Irrigation Scheduling Demonstration Project in Nova Scotia" will be prepared based on the findings of this Investigative Travel.

Plenary Session

Challenges - 90's

Robert Saintonge
Past-Chairman, APASCC
NB Department of Agriculture, Fredericton

The 1988 gross farm income distribution in Atlantic Canada was $54.7 million in Newfoundland, $207.2 million in Prince Edward Island, $252.3 million in New Brunswick and $311.3 million in Nova Scotia for a total of $826.6 million. Although this represents only 3.7% of the total gross farm income in Canada, the agricultural industry is very, very important to the Atlantic Region.

Approximately 386 900 weeks of employment are created on farms in the Region. Also, approximately 580 000 weeks of employment are created in the machinery, feed, chemical, construction, and other industries that provide development and operational services to farmers in Atlantic Canada. Agriculture is ranked as one of the top five industries in each Atlantic Province.

As we enter a new decade, it seems appropriate for agricultural professionals to consider our current position and the challenges and opportunities that are facing agriculture in Atlantic Canada. The purpose of this plenary session is to provide each APASCC Committee, representing animal production, crops, food, socio-economic services, soil and climate, and agricultural engineering an opportunity to express their view on the theme 'Challenges-90's'. Also, since we are participating in the annual Agricultural Engineering Workshop, the engineering audience present here is interested in the innovations and progress being made in the other disciplines/areas of agriculture that agricultural engineers should be aware of and/or involved with in the future.

It is the objective of this session to encourage a continuing multi-disciplinary approach to solving problems in agriculture and meeting the challenges of the 90's.

Atlantic Committee on Animal Production
Ted Van Lunen
Agriculture Canada, Experimental Farm, Nappan, NS

The sectors of animal agriculture which can benefit most from engineering inputs are the poultry sector, the hog sector, and the fur sector.

At present, the hog industry is experiencing some financial trouble due to low pork prices. This appears to be causing the industry to consolidate into fewer, larger, more efficient farms. These farms depend more heavily on technology for ventilation, feed processing and delivery, and manure handling. In addition to financial pressures, the public is demanding that more attention be paid to animal welfare, the environment, food safety, and meat quality. All these areas require engineering expertise to meet the challenge. Manure storages must be developed to reduce environmental risk, reduce odours, and maximize nutrient recovery for fertilizer. Ventilation is a chronic problem and work is always needed in that area. Feed represents 70-75% of the total cost of production for pork, and much work can be done to reduce this cost. New feeder designs may reduce waste while inexpensive liquid feeding systems would allow the use of less expensive by-product feeds.

In regards to animal welfare, new pen designs and technologies which permit efficient open housing of sows are needed.

The pork industry is one which has traditionally used higher levels of technologies as compared to some other sectors and engineering will play a major role in its survival in the future.

The poultry sectors will realize less growth in the 90's than in the 80's and, in the case of egg layers, the table egg market will continue to shrink as processed egg products take more of the market volume.

Equipment evaluations and cage designs will be the main areas of activity as existing facilities are retrofitted. Enhancement of building interior environment should produce greater flock uniformity and improved productivity. Greater efficiencies of production will be key areas of concern so Maritime producers strive to remain competitive within the Canadian industry.

The fur sector requires more automation in feeding and watering systems to reduce labour inputs. Presently, most of the technology is coming from Scandinavia, but there is no reason why locally available materials could not be adapted to the industry. Information on cage and pen designs needs to be

more widespread. More knowledge must be acquired on Chinchilla production.

As producers grow from part-time to full-time fur production, we must ensure that they do so in a less labour-intensive fashion, while maintaining the fur quality of their breeding stock.

Atlantic Committee on Crops

Jack Cutcliffe
Agriculture Canada, Research Station, Charlottetown, PEI

Crop production in the Atlantic Provinces, as throughout Canada, has gradually and continually become more mechanized and more capital intensive with larger production units. Crops in the Region are produced on a wide range of farm sizes - from 1000 acres or more of potatoes or cereals to 10 acres or less of vegetables and/or berries. Production is more diversified, in terms of numbers of different crops produced, than most agricultural regions of North America and many farm units have livestock as well. Marketing of locally produced crops is also very diversified. Crops are marketed: direct to consumers; to retailers, to processors; through wholesalers, dealers, Co-ops, and via livestock. Except for tobacco, all crops are marketed without marketing boards or production quotas. There are many underutilized hectares as well as many previously cleared and not cropped hectares of good farm land within the Region. Commodity prices relative to production costs, in general, have not recently provided sufficient incentive for expanded production of most local crops.

There is increasing concern about the environment and the potential adverse effects that present cropping practices might have on soil and ground water. There will be pressure on the farming community to adopt practices that will, or are conceived to, enhance sustainability of food production. Pesticide use in crop production will decline. There will be increased production by "organic" methods. Probably most production will be a "middle approach" whereby crops will continue to be grown on an extensive scale with some system of certification of freedom from harmful pesticide residues.

Marketing of agricultural commodities is becoming more globalized. It will be increasingly important for crop production to be competitive with production elsewhere. To remain competitive, it will be necessary for

production units to continue to increase in size. This translates into greater requirement for capital, and with narrow profit margins during the 1980's there has been very limited opportunity for the farming community to accumulate capital. Acquisition of adequate capital for crop production may be a major challenge in the 1990's. The effect of the Canada/US Trade Agreement on crop production in the Atlantic Provinces is uncertain. It will no doubt result in opportunities and constraints which will take time to identify.

Recent advances in the technology of tissue culture and gene transfer have greatly enhanced man's ability to manipulate plants to advantage and result in more efficient and more reliable crop production. It will become increasingly feasible to develop cultivars that will have the ability to produce higher yields and/or improved quality and greater resistance to pests.

Crop production practices in the 1990's must accommodate economics, greater assurance of food safety, and environmental sustainability.

ENGINEERING RESEARCH AND DEVELOPMENT NEEDS FOR THE 1990'S AS SUGGESTED BY THREE ADVISORY COMMITTEES OF THE ATLANTIC COMMITTEE ON CROPS (FEB. 1990)

Advisory Committee on Greenhouse and Ornamental Crops:

The greenhouse people would like to see some work done on greenhouse structures and heating systems - not as alternatives to fuels but careful designs of heating systems, maximum output of fuel, and some evaluation of efficiency of heating systems and work lines.

Advisory Committee on Tree Fruits:

- Inexpensive construction methods for controlled atmosphere (CA) storage
- Waste management systems for both on-farm and off-farm generated wastes
- Spraying equipment using lower volumes, targeted application, and/or enclosed application systems
- Equipment to improve harvesting procedures, such as inexpensive systems to pre-sort fruit

Advisory Committee on Vegetable Crops:

- Mechanization of planting and harvesting
- Packing house equipment

- Installation of plastic tile in peat soil
- Transplanter for plastic mulch on peat
- Smaller equipment
- Inter-row method of cultivation
  What equipment is available and how suitable is it for crops e.g. lettuce and onions? Trend - more cultivation and less use of herbicides
- More efficient spraying equipment
- Vacuuming insects instead of using insecticides
- Description, pictures, and evaluation of equipment on a computer for easy access
- Post-harvest equipment - cooling - small
- More involvement by engineers in the evaluation of machienry in Technology Enhancement Projects
- List of engineers indicating in what area they can be contacted for advice
- Pooling of information gathered on machinery evaluation from ERDA projects

Atlantic Committee on Food
Robert Stark
Agriculture Canada, Research Station, Kentville, NS

- No abstract available

Atlantic Committee on Socio-Economic Services

Robbie Hayman

Nova Scotia Department of Agriculture, Truro

We work in an industry where change has been the one constant over many generations and will continue to influence our decisions in the future. As we move rapidly toward a global marketplace for our products, as key issues such as GATT, Animal Welfare, Environmental Concerns, and uncertain Economic Policy play an ever increasing role in our lives, we must learn to adapt to new, more effective ways to serve our clients.

Our challenge for the 90's, as agricultural professionals, will be to find new imaginative solutions to complex production and management problems faced by our clients. This new environment will mean a greater interdependence on each other - a teamwork approach. By working together, we have the technical expertise and skills required to solve the complex problems facing us. We must be competitive; we must be able to produce and market our products at a profit. We must have greater co-operation among all sectors of the Agri-Food Industry so that, together, we can build on an industry that is fundamental to our survival as a country.

Atlantic Committee on Soil and Climate

George Read
NB Department of Agriculture, Fredericton

Consumers are and will continue to be a driving force in the upcoming decade, demanding more but also making themselves more knowledgeable. This is a positive force for land use and agriculture in general. The consumer expects more environmentally friendly methods, in their food production systems as well as all products. However, as a better informed consumer, they are recognizing that the respect for the environment comes at some cost. As a result, farmers may get the general public to share in the cost, through the market place, of financing longer term sustainable development rather than short-term gains, resulting in a benefit to the producer and the public.

The trend toward a more integrated approach will be even more important in a sustainable system, and soil and climate activities in the nineties will be integrated into the total production system. Soil management, climate management, crop management, pest management, equipment selection and design, and farm management and marketing will each be an integral part of production decisions. The technical responsibilities in developing new technologies which are environmentally sensitive and friendly should fall on the agricultural industry, the producer, the researcher and the extension staff.

The nineties will certainly be challenging with respect to an existing set of conditions, however, this period will be typified by potentially unprecedented change. Climatic changes, such as increased variability and potential warming in Atlantic Canada are possible; losses in our soil base must be addressed; potential demands for water under higher evaporative demands along with water quality problems may increase; and technology will advance at a remarkable rate. These general factors will provide the framework for the following problems:

- Compacted subsoils and soil moisture will continue to be a major limitation to our land base in the Region. Do you solve these problems by alleviating compaction or by improving drainage, or by a combination of the two?
- Soil conservation is a concern in New Brunswick and Prince Edward Island and to some degree in the other provinces. The acreage involved and the current effort necessitate more conservation implementation.

- Land clearing will continue for certain commodities; a large enough land base must be available to support expansion and improve our competitive position. Professionals are concerned about whether it is economically appropriate to clear land and whether the methods used are the least damaging.
- Weather variability under changing climatic conditions will be very important. In addition to better long-term planning of the climatic risk to crop production, more extensive use of weather proofing methods will be required such as irrigation for frost and moisture control, windbreaks, and site selection.
- Essential elements of the farm plan should include: on-farm soil classification, computer derived soil interpretive maps, involvement of soil surveys in monitoring soil quality, optimizing site selection, and identifying soil physical problems.
- Changes are expected in fertilizer products and method of application, liquid, foliar sprays) manure utilization, and the use of low input systems.
- Farmers have shown they can adapt to rapid change; it is the challenge of engineers and to others to provide the appropriate technology to advise and assist in sutainable development at a competitive cost.

Atlantic Committee on Agricultural Engineering

K.C. Watts
Technical University of Nova Scotia

The accomplishments of the ACAE and its Advisory Committees, for the past decade, include information dissemination via the video, factsheets, and bulletins; instigating the formation of several agricultural engineering related bodies such as the Farm Mechinery Show, ALICA, and the Atlantic Farm Mechanization Institute; influencing research activities in the Region; and increasing the technical knowledge of its members.

There are several forces that are generating changes for the 1990's that, in turn, give rise to a number of challenges for the members of ACAE for the next decade. These driving forces include environmental concerns, the animal rights movement, consumer pressure, dwindling energy sources, advances in technology, the free trade policy, the demise of the family farm, and the low food price policy. These forces generate different challenges for each advisory committee.

The ACFPE will be concerned to reduce the environmental impact of waste water and plastic packaging; to produce fresher products in modified atmosphere packages desired by the consumer; to reduce the energy consumption in cooking and blanching processes; and to use advanced technology to automate quality assessment and process optimization.

The ACPM will be involved in refining the use of sprayers for pesticides; reducing the energy demand on the farm; understanding new technology and encouraging its use with economic viability and environmental sensitivity; increasing the efficiency of a farm through optimizing the selection and testing of farm machinery; and improving the quality of farm produce through reduced damage from rocks.

The ACSE will be seeking to reduce the consumption of energy in farm buildings; to design buildings with more sensitivity to worker and animal health; to investigate better CA storages for fruits and vegetables; and to ensure that the farm wastes do not pollute the environment.

The ACSW will seek to determine cost effective farm management practices that do not result in negative environmental practices. This will involve research on drainage, erosion control, water management, and water quality. The advanced technology of "Field Based Information Systems" will be used to monitor the use of pesticides and fertilizer on a field or part of a field.

Poster Session

The Use of Computerized Surveying Equipment in the Design and Setting Out of Erosion Control Structures

Ron DeHaan

PEI Department of Agriculture, Charlottetown

In the fall of 1987, the Engineering Section of the PEIDA purchased a Wild Leitz total station surveying system complete with a T-1000 Theomat, a DI-1000 Distomat, a GRE 3 data logger, an Epson Equity III+ 286 PC, and TOPOS, COUNTOUR, and AUTOCAD software. The computer has since been upgraded to a Samsung S800 with 60 mega byte hard disc and a 386 math co-processor chip.

The utilization of this equipment automated the surveying and plotting process. As a result, topographical drawings with spot elevations and contours could be produced for large acreages in a matter of hours. Drainage and erosion control plans are then developed from these drawings.

In the fall of 1988, the Engineering Section expanded its use of the total station system. Designs for erosion control systems were created with the aid of Autocad. Coordinates for points along each diversion terrace and grassed waterway were developed in the computer and downloaded back into the field data logger. With the use of a "set out" subroutine the entire erosion control system was then layed out in the field with the total station. This method ensures exact placement of the terraces and other structures as depicted in the plan.

Evaluation of Automatic Depth Controller

Nabil Rifai
Nova Scotia Agricultural College, Truro

Accurate control of the working depth of agricultural implements is one means of increasing crop yields, saving fuel, and improving fertilizer and chemical application.

An automatic depth controller, model DCU-3, was purchased, evaluated, and tested for ease of installation, adjustment operation, safety, and reliability. Measurements were taken and observations were made to determine the effectiveness of this electronically controlled hydraulic system intended for maintaining constant implement depth in varying field conditions and tractor speed. The standard statistical parameters, mean, standard deviation, coefficient of variance, and variance ratio were used to analyze our data.

Nova Scotia Erosion Risk Potential

Robert Gordon[1] and David Langille[2]
[1]Nova Scotia Department of Agriculture and Marketing,
[2]Agriculture Canada, Truro

Rainfall and runoff erosivity indices for Nova Scotia were calculated based on the once-in-2-year, 6 hour rainfall. Isoerodent maps were plotted based on the calculated rainfall and runoff indices. Another set of maps with corrections for winter conditions were also plotted. The rainfall and runoff erosivity indices were combined with soil and landscape physical characteristics. Using the USLE, the combined rainfall indices and soil characteristics from the various polygons of the Generalized Soil Landscape Map for Nova Scotia were used to produce erosion risk maps.

Identification of Mechanical Injury of Potatoes on Packing Lines

G.C. Misener, C.D. McLeod, and L.P. McMillan
Agriculture Canada, Research Station, Fredericton, NB

The level of mechanical injury of potatoes was measured in a survey of table potato packing companies. Four packing lines were monitored during the 1988-89 season with samples taken at eight locations throughout the lines. The sampling procedure was conducted three times during the season. A damage index that included blackspot and measures the severity of injury sustained by the potatoes was calculated for each sample. The potatoes at the growers' storages had an average damage index of 490.6 whereas the indexes of the graded potatoes packed as count boxes, Canada No. 1 and Canada No. 2, were 591.7, 529.4, and 594.1, respectively. Parameters considered to influence the damage levels during the handling and grading process were compared with the injury levels of the potatoes at each sampling location. The parameters considered in the analysis to have a direct relationship to damage levels were the accumulated drop heights, the accumulated number of drops, and the conveyor speeds. The number of people working on the lines was expected to produce an inverse relationship.

Computer Assisted Layer Management

James Shand
Life Line Software Ltd., Truro, NS

This display consisted of posters explaining the various elements of the FARMAX system and reported on the results of field trials in the Maritimes.

Live demonstrations were given as well as a demonstration on how to use computerized Graphical Analysis to solve ventilation system performance problems in livestock buildings.

A Management System for the Monitoring of Impact Damage to Fruits and Vegetables

K.I. Wilkie
Technical University of Nova Scotia, Halifax

Millions of dollars are lost each year due to mechanical damage of fruits and vegetables during mechanized handling. Several researchers have developed artificial fruits and vegetables to sense damage causing conditions during handling, but few have incorporated these "in-situ" sensors with the management process. This paper presents a management based system currently under development. This system includes: a generic artificial fruit/vegetable; a multi-receiver radio telemetry system to allow real-time monitoring of location in the handling process as well as damage severity; sensors to measure and record process variables at the time of damage (such as temperature, belt/chain/ground speed, etc.); fixed fibre optic links between sensors/receivers and a central processing and storage unit (CP&SU); a microcontroller based CP&SU; a temporary data link between the CP&SU and an IBM PC laptop; and a spreadsheet based data analysis and display software package.

Subsurface Drainage Performance on a Queens Soil

Laurie Cochrane[1], Ali Madani[2], Trent Webster[2], Eric Bosveld[2], and Dennis Moerman[2]
NSAS[1], NSDAM[2], Truro

Subsurface drainage performance is being investigated on a compact till, Queen's Soil in Cumberland Co., NS. The primary objective of this research project was to determine which of 3, 6, 9 m spacings is the most cost effective.

Spacing treatments were replicated three times, with each of 9 individual plots outletting into a heated building.

Outflow, precipitation, and water table heights are being continuously monitored since September, 1989. Preliminary results, although not conclusive, indicate the 3 m spacing has a drainage coefficient of three times the 12 m spacing. Yield data has shown no significant difference between the plots for the past growing season.

An Image Acquisition and Processing System for a Robotic Strawberry Harvester

Mark Kane and K.I. Wilkie

Technical University of Nova Scotia, Halifax

A current research project involves harvesting strawberries using visual feedback from a digital camera to guide a robotic manipulator. One problem was locating individual berries in a cluster in order to target them for picking. An image acquisition and processing system is presented which acquired an image of overlapping strawberries and then, through software, segmented the group into individual berries. The hardware consisted of an IBM PC compatible computer and an EDC 1000 digital camera. The software combined routines provided by the camera manufacturer with others developed specifically for this application.

Bruising Location on PEI Harvesters

Tony Glencross

PEI Department of Agriculture, Charlottetown

A video was shown that depicts areas on a potato harvester that have potential to cause severe injury to potatoes. The video uses on-farm situations to stress the importance of correct harvester adjustment to minimize the mechanical injury of potatoes.

Lubricants and Their Uses

Lloyd Hicks
Esso Petroleum

The effect of the impending lack of leaded fuel for tractors and marine engines was discussed. There is little chance that petroleum companies will continue to produce unleaded fuel for the limited market that the farm community would provide. Additives are available for unleaded fuel but are costly ($3.75 for a can to mix with 25 litres of fuel). The fuels from different refineries are not all equivalent; eg. Irving removes the waxes to prevent blocking fuel lines and injectors in the cold weather (giving rise to 5% reduction in heating value) whereas Esso uses additives to keep the waxes from crystallizing out.

Only four refineries in Canada produce lubricants from scratch. All the others use the base oil produced at these refineries and add their own additives, up to 15% of the total lubricant. The base oil affects the following properties: solvency and anti-oxidant properties, low temperature performance, sunlight stability, and seal swelling. The crude oil is refined by: distillation; solvent extraction to remove the multi-ring aromatics; solvent dewaxing; and hydro finishing to remove any traces of solvent and sulphur. With each stage of processing, the pour point is lowered. However, additives still need to be used to depress the pour point even further. Additives are compounded mainly from organic compounds and are also used as: oxidation inhibitors, dispersants to keep the sludge in suspension, corrosion inhibitors, detergents, anti-wear agents, foam inhibitors, emulsifiers, metal deactivators, friction modifiers, tackiness agents (such as is required to keep the oil on a chain), bactericides, and rust inhibitors. Viscosity modifiers to obtain a multigrade oil use molecules that are curled up at low temperatures but open up at higher temperatures to give greater viscosity. The viscosity index of multigrade oils is high: ie. a large temperature change is required to produce a significant change in viscosity. The oil classifications of the Society of Automotive Engineers, American Petroleum

Institute, and the American Society for Testing Materials were discussed. A video showing the effect of too thick an oil on start up of an engine demonstrated that there is significant delay in oil reaching the valve train assembly for oils such as 10 W 30 at very low temperatures. It was noted that 70% of engine wear occurs at start-up. The problem that a farmer has in maintaining a large stock of different hydraulic oils was discussed. It was noted that some oils labelled for a specific piece of farm equipment was produced by Esso and probably was equivalent to a much less expensive Esso oil. It was noted that no oils should be subjected to freeze/thaw cycles because the additives can settle out.

Pesticide Application Technology

C. Riley
NB Research & Productivity Council, Fredericton

- No abstract available

Aerial Sprayer Technology

E. Kettela
Forestry Canada, Fredericton, NB

- No abstract available

Soil and Water Projects in Western Canada

D.I. (Don) Norum

Department of Agricultural Engineering, University of Saskatchewan, Saskatoon

Soil and water research projects in western Canada involve snow management, infiltration into frozen soils, erosion, salinity, use of groundwater, waste disposal, and irrigation as well as other projects.

Because the annual precipitation in much of the Prairie Region is only 300 - 350 mm, even a small increase in soil water storage in the spring can produce a significant increase in yield (roughly 10 kg/ha cereal for 1 mm water). Increases in soil water storage are brought about by various methods of snow trapping and by subsoiling in the fall so that there is enhanced infiltration capacity in the spring.

Reduced soil degradation is being attained by studies on both water and wind erosion and salinity. Projects are underway to look at the use of saline groundwater from deep aquifers for irrigation and to determine if it is feasible to use artificial recharge to enhance storage in surficial aquifers that are used for domestic purposes. Studies show that pelletized sewage sludge can be used as a very effective fertilizer.

The Canada/Saskatchewan "Irrigation-Based Economic Development" (IBED) Agreement will result in approximately 100 000 ha of new irrigation in Saskatchewan. All this will be by pressure pipeline to the farm. In addition, the agreement will result in enhanced wildlife habitat areas, rejuvenated irrigation systems in the Southwest, and investigations into new markets for crops grown under irrigation.

The Federal Environmental Assessment and Review Process

William J. Couch
Federal Environmental Assessment Review Office, Ottawa, ON

The Federal Environmental Assessment and Review Process (EARP) derives its mandate from an Order in Council, EARP Guidelines Order (June 22, 1984). The Federal Environmental Assessment Review Office (FEARO) administers the EARP. The Process requires that an environmental assessment be done for all proposals planned by a federal agency, as well as the proposal of any other entity or person that requires a decision by a federal agency because the action involves federal monies, lands, or could affect an area of federal jurisdiction. EARP is based on the principle of self assessment. This means that all federal agencies must develop their own procedures (including exclusion lists for environmentally benign projects) and obtain FEARO's concurrence on their acceptability. The federal initiator uses its procedures to assess all of its projects for environmental impacts and informs FEARO of its decision in summary form for publication in the Initial Assessment Bulletin. The initiator must decide whether a proposal may proceed with or without mitigating measures, should be modified or abandoned, or be referred by the initiating minister to the Environment Minister for a public review by an environmental assessment panel. A panel is a small group (3 to 7) of independent experts who issue guidelines for the preparation of an Environmental Impact Statement (EIS) to the initiator, reviews the EIS, conducts public hearings, and submits its report containing recommendations to the Ministers of the Environment and the initiating department.

The federal EARP is now in transition. In the case of the Rafferty/Alameda dam project the Federal Court decided that the Process is not a simply guideline whose application is optional, but is a legally binding regulation. This decision and several subsequent rulings have caused uncertainty about Process application. Also, in 1987 the Environment Minister directed FEARO to develop a federal environmental assessment act. This work is under way.

The Environmental Assessment Process Within the Agriculture Development Branch

Robert B. Stewart

Agriculture Canada, Agriculture Development Branch, Ottawa, ON

Over the last couple of years, the Federal Government has been moving to put in place the Environmental Assessment Act to replace the Environmental Assessment and Review Process Guidelines Order-in-Council (OC) which was put in place in June of 1984. The Federal Court Decision in April of 1989, which stopped construction of the Rafferty-Alameda Dam in Saskatchewan because federal EARP requirements had not been met, in effect, accomplished this by changing the above noted OC to a regulation. To meet the requirements of the current OC Guidelines and avoid similar court challenges, Agriculture Canada has proceeded to develop and implement environmental assessment procedures that will enable the Department to publically demonstrate that it is fulfilling its EARP obligations. The Federal Environmental Assessment and Review Process (EARP) and Agriculture Canada's responsibility for EARP is described. The Environmental Assessment Process being implemented by the Agriculture Development Branch, Agriculture Canada and the implication for land development activities under the federal/provincial cooperative agreements are discussed. The roles and responsibilities of personnel involved, the use of provincial environmental assessment processes, and the role of the Federal Environmental Assessment and Review Office (FEARO) and Environment Canada in assisting Agriculture Canada in the undertaking of its EARP obligations is outlined.

CONCURRENT WORKSHOPS
Structures and Environment

Dairy Housing Systems as we Approach the 21st Century

Robert J. Milne
Farmstead Planning & Environmental Consultant, Argue & Associates, Guelph, ON

There are a number of factors that are influencing farmers' decisions regarding housing of dairy cattle at this time in history. Many of these factors are almost completely beyond his control and most of them have not yet been clearly defined. These include:

- the effect of free trade on the supply management system and on overall markets for all livestock products,
- the final deliberations of GATT on the protection of home markets for certain dairy products,
- the direction being taken by other major dairy producing countries in the world,
- the success of attempts by developing countries to improve or to develop their own dairy herds,
- the rapid change in dairy equipment technology such as robotic milking - how soon and how practical,
- the animal welfare issues; will such concerns be settled rationally and discussions be based on documented research or on emotion and public opinion?
- the environmental issues relative to water, air, noise, and aesthetic pollution potential of livestock operations,
- the overall economic climate of the next few years

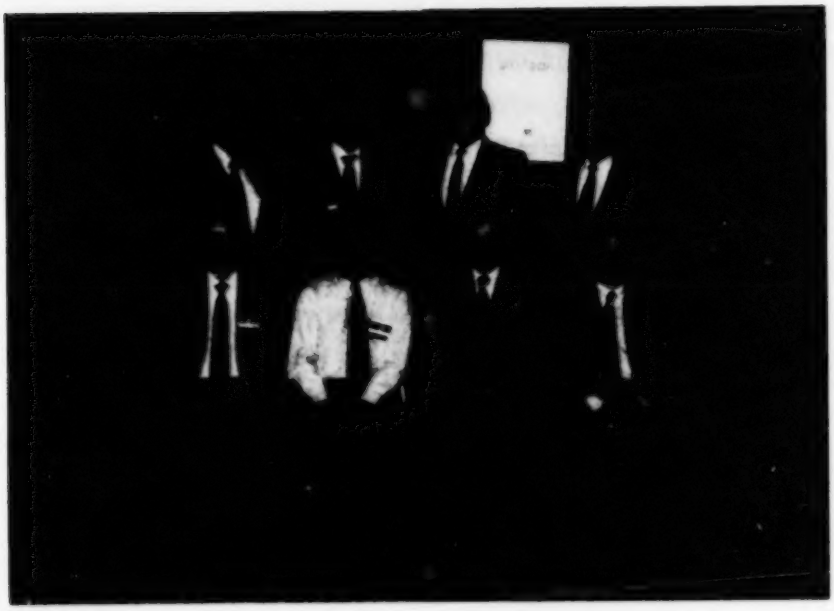
Regardless of how these issues are ultimately resolved, some conclusions appear obvious, and I feel that dairy housing decisions should largely be based on these conclusions:

1) We must become extremely competitive in the world marketplace. Surplus milk must be sold at a profit to this market.
2) Productivity per man as measured by milk produced per man and cows milked per man, must increase dramatically. Short-term goals should be 1 000 000 lbs. of milk per year per man and 55 cows milked per man with 75 cows per man for our leading dairy farmers.

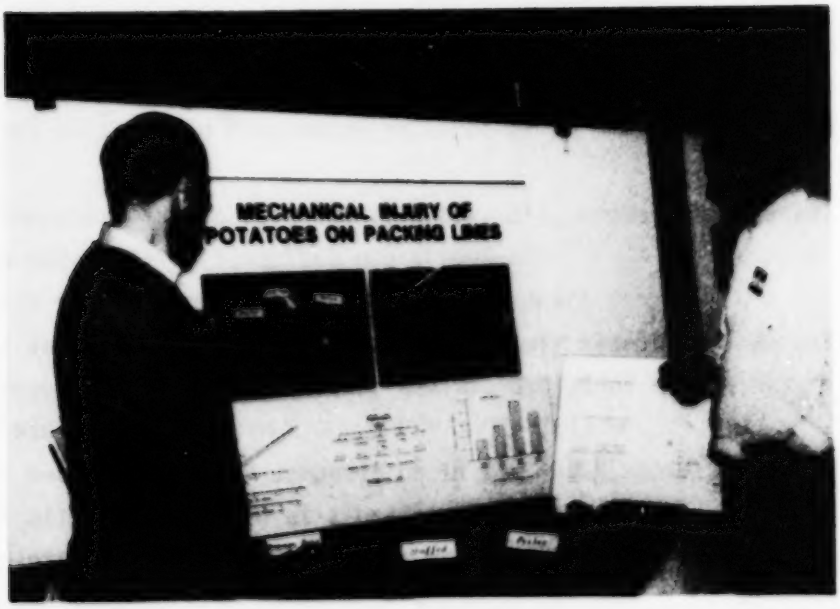
3) Milk productivity will increase rapidly to annual goals of 25 000 lbs. per cow.
4) Dairy herds are likely to increase in size, and the number of dairy herds will decrease as many herds expand to over 200 milking cows.
5) Tie stall dairy barns will diminish in number and will have much less influence on the genetic makeup of our dairy herd.
6) Our dairy farmers must adapt new technology as quickly as it is developed and is shown to provide economic benefits.
7) Buildings, although larger, will be simple in concept and less costly. Horizontal silos will be accepted more widely as suitable forage feed storages and earthen structures will be widely used for manure storages.
8) Further regulating agencies and legislation must be minimized to allow Canadian dairy farmers to be competitive in world markets. Conversely, educational efforts of agricultural engineering extension groups must be supported and strengthened to help farmers achieve these goals in a manner that is acceptable to non rural society.

There are many opportunities and challenges ahead. Let us go forward with optimism and courage so that the dairy engineering being developed today will help our industry meet the goals of tomorrow.

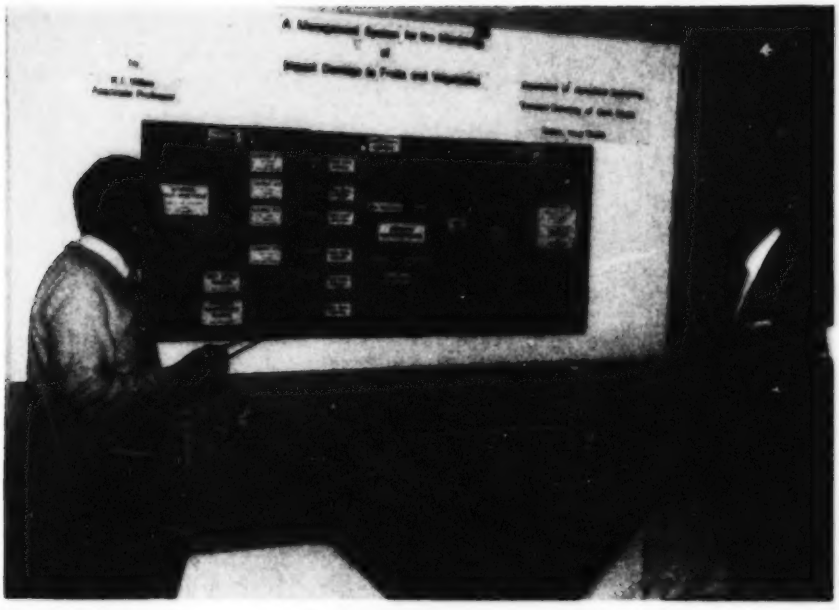
Scenes from the 1990 Winter Workshop



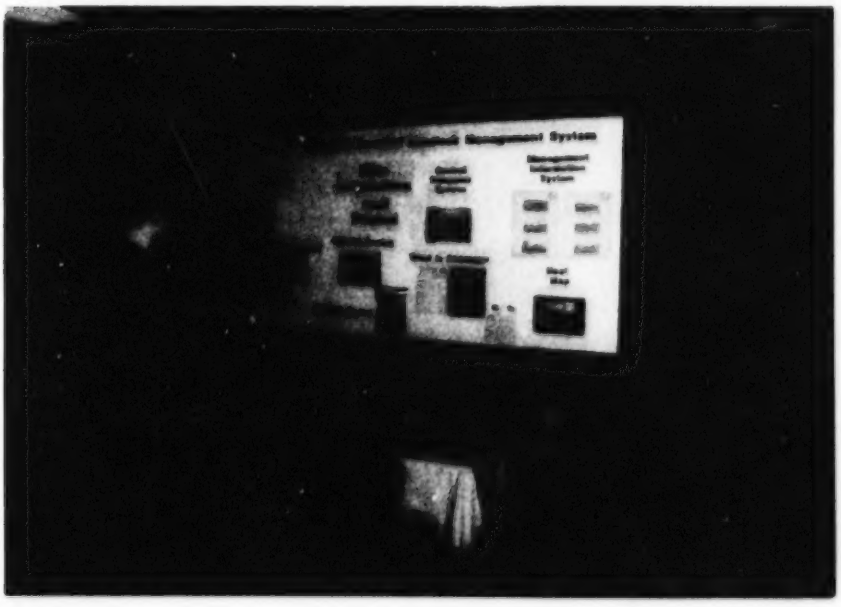
a) Speakers from Plenary Session



b) Poster Session - Mechanical injury of potatoes on packing lines



c) Poster Session - Monitoring of impact damage to fruits and vegetables



d) Poster Session - Computer assisted livestock management

e) Poster Session - Erosion control structures

f) Poster Session - Robotic strawberry harvester